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SIMULATION GAMES AND SOCIAL THEORY. OCCASIONAL PAPER.

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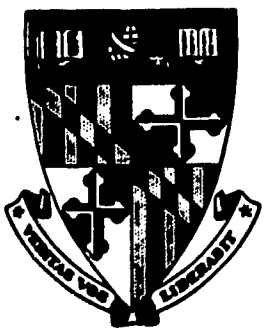
DESCRIPTORS- *GAMES, *SIMULATION, *BEHAVIOR THEORIES, *LEARNING PROCESSES, *ROLE PLAYING, REACTIVE BEHAVIOR, GAME THEORY,

GAMES INTEREST THE SOCIOLOGIST BY DEMONSTRATING MOTIVES AND BEHAVIOR THAT OCCUR IN REAL LIFE AND BY FACILITATING LEARNING THROUGH THEIR RULES, REWARDS, AND LOSSES. SOCIAL SIMULATION GAMES EXPLICITLY MIRROR CERTAIN SOCIAL PROCESSES. EXAMPLES ARE (1) THE FAMILY GAME, BETWEEN CHILD AND PARENT AND THE COMMUNITY OF CHILDREN AND PARENTS, (2) THE DEMOCRACY GAME, BETWEEN LEGISLATORS VYING FOR VOTES, AND (3) THE LIFE-CAREER GAME, WITH A YOUNG PERSON RESPONDING TO TEACHERS, REGISTRARS, EMPLOYERS, AND POSSIBLE SPOUSES. THE NECESSARY RULES INCLUDE THE PROCEDURAL RULE, THE MEDIATIVE RULE, THE BEHAVIOR CONSTRAINT, A SPECIFIED GOAL, AN ENVIRONMENTAL RESPONSE, AND THE POLICE RULE, ALL PARALLELING NORMAL CONSTRAINTS IN REAL LIFE. THESE GAMES SHOW A RELATIONSHIP BETWEEN THEIR RULES AND CERTAIN BEHAVIOR THEORIES--PURPOSIVE, POSITIVIST, EXPRESSIVE, FUTURE-GOVERNED, ALTRUISTIC, ETC. THEORETICAL DEVELOPMENTS AKIN TO THE PURPOSIVE THEORY DEPEND MAINLY ON THE IDEA OF EXCHANGE, FROM WHICH EACH PARTY EXPECTS A GAIN. IT MAY BE A TANGIBLE OBJECT, A UNIT OF CONTROL, SATISFACTION, A PROMISE, TRUST, ESTEEM, OR ANY COMBINATION OF THESE. THE CONSTRUCTION OF THESE AND OTHER (E.G., NO-FINAL-SCORE) GAMES PERMITS THE TRANSLATION OF A SET OF IDEAS INTO ACTION FROM WHICH MAY BE EXTRACTED A BEHAVIOR PROCESS THAT DESCRIBES, BY ITS RULES, THE CONDITIONS THAT WILL GENERATE THE PROCESS, THIS USE OF SIMULATION GAMES IS CONSIDERED USEFUL IN STIMULATING AND REINFORCING THE LEARNING PROCESS. (HH)



THE JOHNS HOPKINS UNIVERSITY

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Occasional Paper

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Games are of interest to a social psychologist or sociologist for at least two reasons. First, because a game is a kind of play upon life in general, it induces, in a restricted and well-defined context, the same kinds of motivations and behavior that occur in the broader contexts of life where we play for keeps. Indeed, it is hard to say whether games are a kind of play upon life or life is an amalgamation and extension of the games we learn to play as children. The book by Eric Berne, Games People Play, describing some socially destructive behavior as games, gives persuasive argument that in fact the latter might be the case. And the perceptive observations by Jean Piaget of the importance of simple games like marbles for young children as early forms of a social order with its rules and norms strengthens this view.

The second source of interest is the peculiar properties games have as contexts for learning. There are apparently certain aspects of games that especially facilitate learning, such as their ability to focus attention, their requirement for action rather than merely passive observation, their abstraction of simple elements from the complex confusion of reality, and the intrinsic rewards they hold for mastery. By the combination of these properties that games provide,

they show remarkable consequences as devices for learning.

Both these topics are dealt with in other papers recently published. I want here to examine how a particular kind of game, a "social simulation game," can provide still another source of interest to the social scientist. A social simulation game, as I shall use the term here, is a game in which certain social processes are explicitly mirrored in the structure and functioning of the game. The game is a kind of abstraction of these social processes, making explicit certain of them that are ordinarily implicit in our everyday behavior. These games raise several questions: What is the way a simulation game characteristically mirrors social processes? What are the kinds of social processes most easily simulated in a game? What is the relation of construction and use of a game to, on the one hand observation and experimentation, and on the other hand social theory? These are the questions I want to address in this paper, beginning with specific questions about how a game mirrors social processes. I will use specific examples from games developed by the Hopkins group as illustrations of the most important points.

The Role of the Social Environment

A social simulation game always consists of a player or players acting in a social environment. By its very definition, it is concerned principally with that part of individuals' environment that consists of other people, groups, and organizations. How does it incorporate the environment into its structure?

There are ordinarily two solutions, either or both of which are used in any specific game. One is to let each player in the game act as a portion of the social environment of each other player. The rules of the game establish the obligations upon each role, and the players, each acting within the rules governing his role, interact with one another. The resulting configuration constitutes a social subsystem, and each player's environment consists of that subsystem, excluding himself.

Examples of this solution occur in most of the Hopkins games. In the Family game, there are two subsystems: one is the parent and child, and the other is the community of parents and children. Each parent's principal interaction is with his child, but he has interaction also with the other players in the role of parents in the game. And each child's principal interaction is with his parent, but he interacts as well with other players in the role of children. The Legislature portion of the Democracy game consists of players in a single subsystem. Each player is a legislator, and interactions are with other players in their role as legislators.

A second way in which the social environment is embodied in a social simulation game is in the rules themselves. The rules may contain contingent responses of the environment, representing the actions of persons who are not players, but nevertheless relevant to the individual's action. A game using this solution can in fact be a one-player game, in which the whole of this player's environment

represented by the game is incorporated in the rules.

An example of this solution is the Life Career game. In this game, the sole player begins as a young person, making decisions about his everyday activities and implicitly his future. The responses to these decisions occur through the environmental response rules, which represent the responses of: teachers in school, school admissions officers, potential employers, and potential marriage partners. But none of these roles is represented by a player in the game. The probable responses of persons in such roles to various actions of a player are embodied in the environmental response rules, and the actual responses are determined by these rules in conjunction with a chance mechanism. The player in the game plays for a score, and the only relation to other players is through a comparison of scores.

Most games use a combination of these two solutions. A portion of the environment is represented by other players, and a portion by the environmental response rules. An example is the game of Legislature. Players receive cards representing the interests of their constituents, and their score in the game consists of votes given by the hypothetical constituents, according to the environmental response rules which make these votes contingent upon the legislator's furthering of the constituents' interests. In some games also, alternative forms have a part of the environment as players in one form and as environmental response rules in another. For example, the complete game of Democracy includes a citizen's action meeting in which the players are constituents who

determine collectively the votes they will give to their legislator contingent upon his action. This moves the behavior of the constituents from the rules into the arena of play.

The embodiment of the social environment in the rules requires more empirical knowledge of the responses of the organizations or individuals than does the solution which represents them by players. For the players respond on the basis of their own goals and role constraints, and the game constructor need not know what these responses will be. In contrast, if the responses are part of the rules, the game constructor must know in advance the responses contingent upon each possible action of the players.

The representation of environment by players, on the other hand, requires greater theoretical acumen. For if the players' responses, and thus the system of behavior, are to mirror the phenomenon in question, each player's goals and role constraints must be accurately embodied in the rules. For example, in the Life Career game, if the role of college admissions officer were to be represented by an actual player, the goals of the officer, together with his role constraints, must be approximately correctly given in the rules, if his selection of candidates is to correspond reasonably well to reality.

The decision to represent a given portion of the environment in either of these ways depends in part upon the mechanics of the game. In some cases, there will be too many players if a given portion of the environment is represented by players; thus it must be represented

by the rules. In other cases, such as the Life Career game, the player moves from one environment to another, so that each environment is only temporarily a part of the game.

Finally, it should be noted that every game selects only certain portions of the social environment to be included in either way. Some portions are left out, often because they introduce social processes other than the ones being simulated. For example, in the game of Legislature, interest groups acting as political pressure groups are explicitly excluded, because of the additional processes this would introduce, obscuring the one being simulated.

Types of Rules

In the discussion above one type of rule of these games was repeatedly mentioned, and described as "environmental response rules." This is only one of several types of rules that are necessary in social simulation games, and it is useful to indicate briefly the several types. This will give some better idea of the elements of which a social simulation game is composed. It is often stated that the rules of a game are like the "rules of the game" in real life, that is, the normative and legal constraints upon behavior. This, however, corresponds only to one type of rule necessary in any game.

The most pervasive type of rule in every game is the procedural rule. Procedural rules describe how the game is put into play, and the general order in which play proceeds. In a social simulation game, the procedural rules must follow roughly the order of activi-

ties in the phenomenon being studied. Sometimes, the procedural rules explicitly incorporate assumptions about the social processes involved. In the Family game, for example, each round of play between parent and child consists of a sequence of four activities: first, discussion between parent and child in attempts to reach agreement about the child's behavior; second, orders given by the parents in those areas where no agreement was reached; third, behavior decisions on the part of the child; fourth, decisions of the parent whether to supervise the child's behavior and possibly punish for disobedience. This sequence of activities explicitly embodies assumptions about family functioning. In some cultures, a different set of procedural rules would be necessary, for example, eliminating the first step. Or a more theoretically sophisticated version of the game would leave the sequence of activities undetermined, to be selected by the behavior of the players.

A sub-type of procedural rule, found in all games, may be called the mediation rule. This is the set of rules specifying how an impasse in play is resolved, or a conflict of paths resolved. In basketball, there is an impasse when players from opposing sides are wrestling over the ball, and the referee calls a jump-ball. In social simulation games, mediation rules are necessary whenever two or more players conflict, and neither has the formal authority or the power to get his way. Mediation in the Community Response game is necessary when two players attempt, in ignorance of the other's action, to operate the same agency. A more important type of mediation is

necessary in the economic system game, when workers and employer cannot agree on a wage. This impasse, if allowed to continue would disrupt the game, just as similar impasses would disrupt the real economy if not subjected to mediation or arbitration.

A second type of rule, closely related to the first, is the behavior constraint. These rules correspond to the role obligations found in real life, and specify what the player must do and what he cannot do. They are often stated along with the procedural rules, but they are analytically distinct, for they represent the role specifications for each type of player. For example, in the Community Response game, each player in a community role is constrained to use only ten units of "energy" in each time period; and if he decides to operate a community agency, he must devote a specified number of energy units to this activity.

A third type of rule is the rule specifying the goal and means of goal achievement of each type of player. In every game, all players have goals, and the rules specify both what the goal is and how the goal is reached. In a social simulation game, the goal must correspond roughly to the goals that individuals in the given role have in real life. Often, the correct specification of this goal is an important aspect of the theory embodied in the game. For example, in the Community Response game, each player's goal is to "reduce his anxiety" as quickly as possible. This, together with the specification in the rules of the amount of anxiety he receives from uncer-

tainty about family, from non-performance of community role, etc., constitutes a theory about behavior under conditions of disaster. Or in the Consumer Economics game, each consumer's goal is to gain the maximum amount of satisfaction. This, together with the schedule of satisfaction received from each type of good purchased, is based upon the economists' theory about consumer behavior. Insofar as the theory underlying goal specification is correct and the behavior constraints are correct, the behavior of the player should correspond to the behavior observed by persons in that role in real life. If the behavior of the player deviates greatly, it is very likely because the theory about the goals of persons in that role is defective.

A fourth type of rule, referred to in the earlier section, is the environmental response rule. These rules specify how the environment would behave if it were in fact present as part of the game. In the game of baseball, some fields with a portion of the outfield blocked off have a "ground rule double," for balls hit into that area. This rule is based on the probable outcome of play if the interference with play had not existed.

In all simulation games, the environmental response rules are more important. Since a simulation game is an abstraction from reality, the environmental response rules give the probable response of that part of the environment which is not incorporated in the actions of the players. In a social simulation game, most of the environmental response rules give the probable response of persons, groups, or organi-

zations not represented by players. Examples are those in the Life Career and other games, as discussed in the preceding section.

There is finally one type of rule in all games as well as real life, which may be called police rules, giving the consequences to a player of breaking one of the game's rules. These rules sometimes specify merely a reversion to a previous state (corresponding to "restitutive law" in society), sometimes specify a punishment to the player who has broken the rules (corresponding to "repressive law" in societies). The principal function of the referee in games (besides applying mediation rules) is to note when rules are broken and apply the designated corrective action.

Ordinarily, the breaking of procedural rules leads merely to restitutive action, while the breaking of behavior constraint rules leads more often to repressive action, punishment of the offending player. In many social simulation games, as in many parlor games, the breaking of a rule is corrected by the moral force of the other players, and their power to stop the game by refusing to play. In a larger game with more players and more differentiated areas of action, police rules are more necessary, as well as a referee or policeman to note the delinquency.

The Role of Behavior Theory

A game used as a social simulation is based upon certain assumptions, explicit or implicit, about behavior. The similarity of the assumptions from one game to another suggests, as further analysis

confirms, that social simulation games have a special kinship to a certain type of behavior theory. In addition, each game designed as a social simulation implies a quite specific theory about behavior in the area of life being simulated. These specific theoretical elements are principally manifested in the goal-specification rules, but also may form part of the behavior constraints, procedure rules, and environmental response rules. Examples of this relation between rules and theory are evident in the preceding discussion; more examples and a closer examination will be given below. First, however, it is useful to examine the general affinities of games to one type of behavior theory.

In every game, each competing unit has a goal specified by the rules, and means by which he achieves this goal. If the competing unit is a team, then all players on this team share the same goal, and have individual goals only insofar as they contribute to the team goal. If it is a player, then he has an individual goal. Even in the former case, individuals as persons (not as players) may have individual goals besides the team goal given by the rules - for example, to excel within one's own team. These goals, however, are not part of the explicit structure of the game, but arise because of the rewards they bring outside the game itself.

Whether the competing unit is an individual or a team, the game functions because each individual pursues his own goal. Thus a social simulation game must necessarily begin with a set of individuals

carrying out purposive behavior toward a goal. It is hardly conceivable, then, that the theoretical framework implied by a social simulation game be anything other than a purposive behavior theory. This means a definite theoretical stance on several issues: On the issue in social theory of expressing the assumptions of the theory at the level of the individual or at the level of the collectivity or social system, the use of games implies taking the former, individualist position. On the issue of purposive theory vs. positivist theory (where behavior is described as a lawful response to an environmental stimulus), the use of games implies the purposive orientation. On the issue of purposive, goal-oriented behavior vs. expressive theory (where the individual act is an expression of some inner tension without regard to a goal), the use of games again implies the purposive orientation. On the issue of behavior determined by personality or other historical causes not currently present vs. behavior determined by the constraints and demands of the present (and possibly expected future) situation, the use of games implies the latter, the theory of present and future-governed behavior. On the issue of purposive, goal-oriented behavior vs. behavior governed wholly by normative expectations and obligations (as, for example, occurs in some organization theory, where the individual's interests play no role, and he is predicted to behave simply in accord with organizational rules), the use of games implies the former, goal-oriented position. The use of games takes as its starting-point the self-interested individual

(except in the case where the competing unit is a team), and requires that any non-self-interested behavior (e.g., altruistic behavior, or collectivity-orientation) emerge from pursuit of his goals, as means to those individual ends. For this reason, social simulation games that use a collectivity, such as a family, as a team to form a competing unit, are not as theoretically complete as are those games in which the individual player is the competing unit. To specify a collectivity as a competing unit prevents simulation of those processes that induce the individual to realize his goals through investing his efforts in a collectivity's action. It may well be, of course, that for a given social simulation, one wishes to take those processes as given, in order to simulate others. For example, in the Consumer Economics game, the goals of the finance officer of the department store are given as the profitability goals of the department store itself. Similarly, players acting as the consumers are given satisfaction points for purchases corresponding to the satisfaction of both husband and wife together, not corresponding to the satisfaction of one alone. For the purpose of this simulation, the question of how the department store manager induces the finance officer to act in the store's interest, or how the other family members induce the consumer to act in the family's interest, are not taken as problematic.

To state the theoretical position implied by the use of social simulation games does not answer all the theoretical questions that arise. Any given game makes certain specific assumptions about goals.

For example, in the Life Career game, the question arises whether the satisfaction points that constitute the game's goal should be given at each time period, so that the player's score is his cumulative satisfaction over the period of play representing a number of years, or whether points should depend only on his final position at the end of the game (say at age 40). This question becomes almost a philosophical one; but it must be resolved to appropriately motivate the player. Again, in the Life Career game, it is assumed that the individual represented by the player can derive satisfaction from several different areas of life, and that his behavior will depend in part upon the relative importance he attaches to these areas (e.g., family, self-development, financial success, etc.). Consequently, one decision in the game is a weighting of these areas by the player, in essence determining his own goals.

In the first level of the game of Legislature, each legislator is assumed to be motivated solely to stay in office; and it is assumed that the sole factor affecting his tenure is his success in passing those bills of most interest to his constituents. Neither of these assumptions corresponds directly to reality, though both factors are present in concrete legislatures. In order to simulate this process, all other elements are suppressed, and the single process abstracted from reality. The resulting simulation hardly mirrors reality, but instead mirrors only one component of it. In the second level of the game, a second source of motivation is assumed for the legislator:

his own position, taken prior to knowledge of his constituent's interests, on each bill. Winning depends both on reelection by his constituents and on his voting in accord with his own beliefs. This introduces merely one more element into the simulation, which remains far from the reality of actual legislatures, but is instead merely an abstraction of certain important processes from them. In the Community Response game, the appropriate balance between orientation to self-interests and to those of the community is important, yet difficult to obtain. In part, this is obtained by a balance between the anxiety elicited by failure to solve individual problems and failure to aid in solution of the community problems. But upon further reflection, it appeared that in addition to mere anxiety reduction in a disaster, individuals are to some degree motivated by their conception of the regard in which they will be held by their neighbors, among whom they must live in the future. Consequently, among the three players who have accomplished the greatest anxiety reduction, the players vote for the one who has contributed most to the community, as the overall winner of the game.

Altogether, specification of the goal for each type of player in a game is the principal means by which theoretical assumptions are introduced into the game. If incorrect goals are introduced, then the behavior of the players will deviate from the behavior that it is intended to simulate, because the players are incorrectly motivated. In most simulations, the goals introduced are only partial goals,

because the game, like a social theory, is an abstraction from reality, and should contain only those motivating elements that produce the aspect of behavior or the processes being simulated.

In addition to the goals of the game, the procedure rules and the behavior constraints are also partly determined by theoretical assumptions. In the Family game, the procedural steps used in the game are, as indicated earlier, an expression of assumptions about the activities that occur in the determination of adolescents' behavior. In every game, certain of the behavioral constraint rules correspond to role obligations of the individual being simulated. Sometimes, these are directly observable in the situation being simulated; sometimes they are not. In the Family game, it is assumed that the adolescent is free to behave as he wishes, subject to possible parental punishment. But in reality, this is so only in some areas, such as staying out at night. In doing school homework, or other activities carried out at home, the parents' supervision may come not merely after the behavior, but during the activity itself, to insure its completion.

The Kinds of Processes Simulated and the Means of Doing so

It is difficult and perhaps unwise to make any general statements about what social processes most easily lend themselves to game simulation, and what is the appropriate means to mirror them. For obviously, judgments about these matters derive from what has been done in very limited experience. Consequently, what I shall attempt here is to make some generalizations about the types of processes the Hopkins

group have so far found it possible to simulate in games, and the kinds of devices members of this group have used in doing so. This may then give some insight into one general style in the development of social simulation games.

First, it is striking that in nearly all the Hopkins games, the player's goal achievement is measured by his achievement of "satisfaction" points, or some variation thereof. In the Community Response game, it is the complement of this--reduction of "anxiety points." In the high school game, it is units of "self-esteem" that the player tries to gain. Only in the Legislature game is there any real deviation from this approach, for the legislator attempts to gain votes from constituents.

Even here, however, if the game were made more complex through introducing other sources of motivation for the legislator, one way of integrating these various sources of motivation to provide a single measure of goal achievement would be to calibrate all the objective measures of achievement (such as reelection, chairmanship on committees, voting in accord with prestated beliefs, etc.) onto a single scale of satisfaction. In fact, it appears likely that this is the source of the widespread use in these games of "satisfaction units" as measures of goal achievement: as the one common denominator against which otherwise incommensurable objective achievements can be sealed.

In relating these objective achievements to subjective satisfac-

tion, two quite different approaches have been used: to fix in advance, as part of the goal achievement rules, the conversion ratios between each kind of objective achievement and subjective satisfaction; and to allow the player himself to fix these ratios. Most of the games use the fixed-conversion approach, but in nearly all the games, a more advanced form can be developed in which the player himself sets these (subject to constraints that prevent him from gaining advantage in later play by strategically-set conversion ratios). In a second-level form of the Life Career game, the player decides the relative importance of each of four areas of life activity, thus fixing his own conversion ratios for satisfaction. In a form of the Community Response game used experimentally, each player was allowed to distribute his initial anxiety points among the different sources of anxiety in a way that corresponded to the relative anxiety he believed he would feel in each area. Similar variations have been developed in the family game, the high school game, and the Direct Democracy game. In all these but one, the setting was based upon the player's own preconceived estimates of the satisfaction involved. But in one game, the high school game, the conversion ratio was determined by the player as a result of his experience in the game: he decided what proportion of his "attention" he should pay to esteem he received from other students and what proportion to esteem from parents. This relative attention then becomes the weighting factor in converting esteem from others to self esteem. This approach, also used in the Life Career game, is the

most theoretically advanced of the approaches discussed above, for it introduces as one of the processes being simulated the selection and modification of goals contingent upon the consequences of the player's actions.

Exchange Processes and Means of Their Simulation

In sociology and social psychology, the recent theoretical developments most akin to the utilitarian, purposive approach used in games depend greatly upon the idea of exchange. This is evident in the work of its principal exponents, Thibaut and Kelley, Homans, and Blau. These theoretical developments, the idea of exchange of intangibles such as deference, acceptance, autonomy, aid, and similar quantities, constitute the foundation of the approach. Each party to the exchange engages in it because of a gain that he expects to experience from it. Thus the question of how social simulation games express the processes of exchange of such intangibles naturally arises.

In the Legislature game, there are two types of exchange, simulated in quite different ways. One is the exchange between legislators of votes, or power over issues. This exchange is not incorporated in the rules of the game, but arises from the motivations induced by the players' goals, together with the fact that no constraints against such exchange exist. The exchange is not expressed by a tangible or physical exchange (as it would be, for example, if pieces of paper representing votes were physically exchanged). This has certain consequences for the functioning of the system: the exchanges are merely

"promises to pay" a vote or unit of control of an issue, and the promise may not be honored; nor is the exchanged quantity easily negotiable by the receiving party.

A second type of exchange in this game is the fundamental exchange of representative democracy: continued support of the legislator by constituents, in exchange for the legislator's pursuit and realization of the constituents interest in legislation. This exchange is simulated through the environmental response rules: the legislator's score is dependent on cards he receives showing the interests of his (hypothetical) constituents.

These two examples from the game of Legislature illustrate that a social exchange process may be mirrored in games either by an exchange between two players, or by an exchange between a player and the non-player social environment, according to the environmental response rules. Both of these cases present certain complications, and each will be examined in turn. For exchange between players, the most fundamental point, though it appears obvious, must be made: the exchange must be motivated for both parties. The exchange must contribute to both players' goals. In the Legislature game, for example, an exchange of control occurs between legislators not because it is prescribed by the rules, for the rules make no mention of such an exchange. It occurs because it is to the interest of each to concentrate his power on those issues that will contribute most to his re-election or defeat. As a consequence, the exchange occurs only when

two legislators see a mutually advantageous exchange of control.

Exchange between players can be either between persons in the same role, such as legislators in the Legislature game, or between persons in different roles, as parent and child in the Family game, consumer and finance officer in the Consumer Economy game, worker and manufacturer in the Economic System game. When exchange is between persons in the same role, as two legislators, only one motivation need be supplied by the theory on which the game is based, for it serves both players. When the exchange is between persons in different roles, two different motivations must be supplied from a more complex theoretical base. For example, in the two-stage form of the Representative Democracy game, each citizen-constituent is attempting to maximize his satisfaction from the collectivity's legislation. He does this through exercising his power in a collective decision (a community action meeting) that determines the legislation that the representative-legislator must obtain in exchange for the constituency's support in reelecting him. Thus for this exchange to take place, two different sources of its motivation must be inherent in the goal achievement rules: the representative-legislator must have control of some actions (in this case, legislation) that contribute to the citizen-constituent's goal achievement; and the citizen-constituent must have control of some actions (in this case, votes for reelection) that contribute to the representative-legislator's goal achievement.

In the Family game, the parent and child negotiate over each of five areas of the child's behavior, and the implicit starting-point is that each has partial control over this behavior. Thus in the negotiation, there is an exchange of control, with each being motivated to gain control of those activities most important to him (i.e., those areas where the child's behavior affects his level of satisfaction more), in return giving up control over those activities of less importance to him. Obviously, it is only in those families where different activities have different relative importance to the child and parent that a mutually profitable exchange can take place.

The initial structure of control in this game is probably not in accord with reality in this game (although the deviation may not affect greatly the functioning of the game). It seems rather that the adolescent has full control over some actions, the parent has full control over others, and for some, both parties have a veto power over the action. However, if the initial structure were changed in this way, the basic commodity exchanged, control over the child's activities, would remain as it is.

There is a more subtle process that develops over time in this game, akin to exchange, but somewhat different. If the parent supervises the child's actual behavior, in a later stage of the game, and punishes the child for deviations from previous agreements, then both parent and child stand to lose in "family happiness." Thus it is to the long-term advantage of the parent to make an investment of trust

in the child, if the child generally honors this trust. (If the child does not, the parent loses satisfaction.) Similarly, it is to the child's long-term advantage to honor the trust, though he may make short-term gains in satisfaction from behaving in ways that give him most satisfaction, regardless of previous agreements. (This investment may also be described as an exchange, with the parent giving up the activity of supervision and punishment in return for the child's giving up immediate gratifications. However, because the returns to the parent are long-term, it appears more useful to describe it as an investment of trust.)

Whenever, as in the exchange between legislators or the agreement between parent and child, there is no exchange of a physical commodity, but merely a promise to perform, the exchange can be considered an investment of trust by the party whose return is most delayed (e.g., in the case of legislators, the legislator whose issue of interest, on which a vote is promised to him, comes up for vote after he himself has delivered his promise). It is seldom, in areas of social behavior, just as in areas of economic activity, that two activities on which an exchange is made occur simultaneously. Thus it is almost always true that one party must make an investment of trust. In economic exchange, one of the principal functions of money is to facilitate exchange by transferring this trust from the person engaged in exchange, to a central authority, whose "promise to pay" will be accepted by all as a trustworthy promise.

In games where the action of other persons or organizations is incorporated in the environmental response rules, such as the Life Career game and the High School game, a different and less explicit approach to exchange exists. The player acts, and the environment responds with either rewards or punishments, depending upon his action. As indicated earlier, the environmental response rules need not show how this response contributes to the goals of the person or organization whose response is simulated. In the high school game, the esteem from parents to the adolescent for his achievements is given by environmental response rules representing the parents, according to a schedule that corresponds roughly to empirical reality. It does not show how the exchange of esteem for achievement contributes to the parents' goal achievement, for since the parent is not a player, he need not be motivated to engage in the exchange. It is evident from this example and similar ones in these games that the theoretical foundations of the game must become increasingly rich as the social environment is moved out of the environmental response rules and into the play by actual players.

The Exchange of Control Over Actions

It appears that exchange processes generally, in social simulation games and in reality, including economic exchange, can be usefully conceptualized as exchange of control over actions. Because of the interdependence of which society consists, actions taken by one person or collectivity have consequences for others as well. When these

consequences for another are great enough, he will seek to influence the action, and often his most efficacious means of doing so is through offering control over another action in return. In economic exchange, where the exchange is ordinarily conceived as "exchange of desirable commodities," or exchange of a commodity for a promise to pay, in the form of money, the present framework would view the exchange as exchange of control over disposal of the commodity. This view accords with that of one of the most perceptive students of the nature of economic exchange, John R. Commons, who insisted that "exchange of goods" is not a fruitful way of describing economic exchange. Commons says, in describing exchange of economic goods, "Each owner alienates his ownership, and each owner acquires another ownership. Prices are paid, not for physical objects, but for ownership of those objects." (The Economics of Collective Action, New York: MacMillan, 1950, p. 46.)

In some cases, the control that is exchanged is full control over an individual action. In other cases, it is partial control over a collective action. Both the processes are mirrored in the games described above. Apart from this distinction, there appear to be several other important structural differences in exchange processes, all of which have been discussed above. One of these is the distinction between actual transfer of control and a promise to carry out the action under the other's direction. The former occurs in exchange of control over economic goods, while the latter is more frequent in

social exchanges, which are ordinarily described as exchange of "intangibles." The so-called intangibles that are exchanged, such as deference, aid, acceptance, are in fact performance of actions in accord with the wishes of the recipient. A third distinction between exchanges is the distinction between exchanges in which both actions occur simultaneously, and those, far more numerous, in which one action occurs after the other, requiring an investment of trust by one player. Although the processes of trust investment do occur in the games described here, none of these games simulate extensive investments of trust, such as those that occur when a group allows its activity to be determined by a leader, or the investments which an organization manager makes in subordinates when giving them control over portions of the organization. Investments of trust such as these give rise to important social phenomena which can be simulated in games like the ones described above.

A final distinction in the structure of exchange processes is between those that involve only two parties and those that involve three or more. It may well be the case that player A has control over an action affecting B, B has control over an action affecting C, and C has control over an action affecting A, allowing a mutually profitable three-party exchange to occur where no two-party exchange could have taken place. Infrequently, such three-player exchanges occur among legislators in the Legislature game; but their relatively infrequent occurrence suggests some serious barriers in their way.

One of these is the mere mechanical difficulty of discovering a profitable transaction and arranging it; another is the greater investment of trust, requiring each of two players to trust another to whom he may have no subsequent means of retribution. However, certain organizational structures are largely composed of exchanges involving three parties, one acting as a guarantor to one party, in much the same way as the government acts as a guarantor of the value of money exchanged in an economic transaction. For example, in a business organization, one employee performs services for another, and is not recompensed directly by the other, but by the overall management of the organization. It is likely that similar structures exist in a less economic framework.

The possibility of conceiving of all social interdependence in terms of interdependence of actions that can lead to mutually profitable exchange of control over actions suggests that all forms of social interdependence can be mirrored by social simulation games, limited only by the imagination, ingenuity, and theoretical acumen of the investigator.

Currency in the System

In economic systems, exchange ordinarily occurs through physical transfer of goods, or by physical transfer of money. In non-economic exchange, there is seldom a physical transfer (though there are exceptions, such as assignment of a proxy to another person, giving him full control over the casting of the vote). Instead, each gives the

other, or promises the other, effective control over an action, by undertaking to act in the other's interest, while still retaining execution of the action himself. As a consequence, perhaps the fundamental difference between economic and social exchange is that nothing changes hands in the latter case. Indeed, it could hardly be otherwise, for in most cases of social exchange, it is intrinsically the other's action in one's interest that is the desired result. Constituents delegate their political authority to their representative; it is his action in their interest that they expect from him. He can carry out his part of the exchange only by acting in their interest—not by giving them physical control over anything.

The critical question, then, is whether in a social simulation game it is possible, and if possible, desirable, to represent such exchanges by physical transfer of something representing the "thing" which is being exchanged. It was indicated earlier that physical transfer does make an important difference, because it allows use of the thing received for further negotiability. Apart from this question, however, it appears unlikely that in most cases anything could be transferred physically, simply because it is "acting in the other's interest" that is being offered. There are exceptions, such as votes, which could be represented as a transferable commodity; but in general, it appears that the nature of most social exchanges does not allow such a transfer.

This is not to say that no elements in social exchange can be

represented by a physical transfer. In nearly all exchanges, the action of one party in satisfying his part of the exchange occurs prior to that of the other. In some of these cases, the payment for the first party's action is not in terms of a specific action in return, but in terms of a kind of "social credit," which the second person can call upon when he needs it. This credit sometimes takes the form of status or reputation, and manifests itself in a variety of ways: deference, willingness to extend trust, and payment through specific actions. It is certainly possible that this "social credit" could be symbolized by a physical transfer of some paper units of account. However, this would be of use only if it served some function: if the notes thus transferred were useful to the recipient, either as negotiable property in further exchange (like the bills of exchange in Lancashire before 1800, which were promises to pay that came to have the property of negotiability, and passed from hand to hand at face value, although they were private accounts between two parties), or as a debt for which the debtor could be held to account in the courts, i.e., in the rules of the game. Yet neither of these things is true of the social credit that is incurred in social exchange. Thus provisionally, at least, it appears questionable whether a representation of the conceptual quantities that arise in social exchange is possible even if it were desirable.

It may well be that the possibility of such representation merely waits upon the further development of ideas, to provide the basis for

a scheme by which accounts are balanced, and also a unit of value in terms of which accounts may be kept. Certainly primitive systems of economic exchange have in early stages not had a unit of value, and have in many ways more nearly approximated social exchange than modern economic exchange.

Yet the introduction of money as a unit of account, and strict balancing of accounts into such systems has changed their functioning, and it may well be that a simulation of social processes must not be based on a conceptual structure that consists of a tightly rational and fully accounted system. However, the idea of a conservative system, in which there is conservation of some quantity, such as energy in a physical system, is an attractive one. The issue must remain unresolved, awaiting further theoretical or game development. It may be noted, however, that if one abandons the idea of social simulation games as necessarily mirroring what is, he can devise games that represent innovations in social organization, just as the credit card is a recent innovation in economic systems and money is an early innovation, and as the bureaucratic organization is an early innovation in social organization.

Selected Issues in the Construction of Simulation Games

To this point, I have described the approach taken by the Hopkins group to mirroring social processes through games. I would like now to discuss certain issues that have been resolved differently in other games.

In all the games discussed above, the players receive a score, which most often is described as "satisfaction." In some other social simulation games however, there is no final score at all. Instead, the players are assumed to measure their satisfaction by the events of the game. Two varieties of this approach can be distinguished. In one, the objective outcomes of the game clearly constitute a measure of winning and losing. Among the games discussed above, the Legislature game, in which each legislator receives votes for reelection rather than "satisfaction points," is closest to this. The votes are objective outcomes, and because they constitute a unidimensional measure, they can be used as a score for the game. Similarly, in the commercial game of Diplomacy, that nation which outlasts all others is the winner.

The use of such an objective criterion is an excellent measure of success in the game, so long as this single objective achievement is in fact the single objective goal of persons in those roles being mirrored by play of the game. This is most often the case in games which constitute a contest for political power or ascendancy. In such games, the final power positions constitute the outcome of the game. But more often, goals of persons in roles consist of a mixture of objective results, results of different types contributing to the person's satisfaction. When this is the case, it appears difficult to use as a measure of a player's success in the game the objective outcomes on any one of the activities that contribute to the goal.

The economist's solution for a similar problem has been to devise a concept of "utility" as a way of giving subjective integration of the otherwise incommensurable objective things toward which the individual strives. Until another theoretical device accomplishing the same thing is discovered, some variant of the economist's solution is necessary.

A second variety of the no-final-score approach stems from quite different directions, from the game designer's distaste for competition, distaste for the idea of "winning" and "losing." It is a defect of social simulation games in general, whether there is an explicit winner and loser or not, that they motivate the players for success relative to others, while in some activities (but not all), his goal derives from the absolute level of results. For example, in the Consumer Economics game, although units of satisfaction accrue as a result of objective purchases, the player is motivated simply to do better than others, that is, to maximize the positive difference between his satisfaction and that of others. Often, this gives behavior no different than would occur if the goal were in fact to maximize his absolute level of satisfaction; but in certain cases, such as those in which he might act to interfere with another's performance instead of implementing his own, it can be different. Yet it is not clearly the case that in real life people strive to maximize the absolute level of achievement, rather than the relative one. The phenomenon of relative deprivation in social life attests to the fact that rela-

tive outcomes do play an important part in one's level of satisfaction.

The principal defect of the no-winner variety of the no-final-score approach is that it assumes what is hardly true: that the player can understand and internalize the goals of persons in the role he is playing in the game, when those goals are not given to him by the rules of the game, and then evaluate his performance on the basis of these assumed goals. For if he cannot, his behavior will be aimless, that is without a goal, or will be directed toward incorrect goals, thus destroying the value of the simulation. Parenthetically, I should note that this anti-competitive view apparently is a misdirected generalization from the harm that punishment through low school grades, and punishment from adults generally, does to children. The idea of winning and losing in a game, and accepting defeat, is an early element in socialization of a child. Children unable to accept defeat in a game are, as Piaget's researches suggest, at a very early stage of socialization, approximately the 4-6 year age level.

A second issue that is sometimes resolved differently in social simulation games is the issue of abstract simplicity vs. realistic complexity. Some games, in the area of international relations, legislatures, business games, and others, have been developed as realistic and complex configurations of processes, attempting to simulate reality as well as possible. In contrast, the games discussed above are analytic abstractions from reality of single processes or delimited combinations of them. The virtues and defects of each approach as a learning device

are not known. But it appears that as aids for theory, they are relevant to different aspects of theory-construction. The simpler simulations are appropriate for detailed study of single processes or small combinations of processes. Yet because they do not attempt to mirror the richness of reality, empirical tests against reality cannot be easily made. There is too little experience, however, to have a good assemssment of the values of empirical richness and analytic abstraction in social simulation games.

The Use of Games as Instruments of Theory

The relation between purposive behavior theory and social simulation games is evident from the discussion in earlier sections. It remains here only to suggest the role that the construction and use of games can play in the development of behavior theory.

Social simulation games appear to be most useful in the intermediate stages of theory development, between verbal speculation and a formal abstract theory. For a simulation game appears to allow a way to translate a set of ideas into a system of action rather than a system of abstract concepts. The concept development is necessary (if the concept of money did not exist, it would be necessary to invent it in order for a system of economic exchange other than barter to exist), but what is necessary is not to specify "relations between concepts" in the usual way that theories are developed. Instead, it is necessary merely to embed the concept in the rules of the game.

In addition to those concepts and action principles that are

part of the design of the game, additional phenomena arise which require further conceptualization, and extension of the theory. For example, in playing the Legislature game, exchange of votes occurs, though this is not in the rules; and observation of this exchange led to: a) conceptualizing the process as one of exchange of partial control over the collective action; b) developing the concept of a player's interest in the action as the difference between the utility for one outcome and that for the other (i.e., reelection votes under one outcome and the other); and c) the proposition that a player will exchange control so as to maximize his control over those actions that interest him most. Again, in the Family game, although the concept of trust and investment of trust plays no part in the rules of the game, behavior arises during the game that suggests these concepts as ways of describing it.

It might almost be said that construction of a social simulation game constitutes a path toward formal theory that is an alternative to the usual development of concepts and relations in verbally-stated theory.* For rather than abstracting concepts and relations from the system of action observed in reality, the construction of a

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*It is interesting to note that Von Neumann and Morgenstern hold a similar view about the theory of games in relation to social theory. They state: "For economic and social problems the games fulfill—or should fulfill—the same function which various geometrico-mathematical models have successfully performed in the physical sciences." J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, 3rd ed. (New York: Wiley Science Edition, 1953), p. 32.

game abstracts instead a behavior process, describing through the rules the conditions that will generate that process. Then, after construction of the game and observation of its functioning, the concepts that adequately describe this process can be created, proceeding then to the development of formal theory. An important virtue of this path is that one learns by malfunctions of the game the defects and omissions in his abstraction of the behavior process. As a consequence, extensive corrections to the theory can be made in making the game function, even before the conceptualization that follows play of the functioning game.